MAE 215 Introduction to Aerospace Engineering Syllabus

(Fall 2016, CRN 81296, Section 001 and CRN 85868, Section H01, MWF 3:00-3:50 PM, ESB G39)

Instructor: Dr. Christopher Griffin, MAE Dept., Statler College
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Instructor's Office Hours: MW 4:00 – 5:00, T 3:30 – 4:30, or by appointment (open door policy)

Course Prerequisites: MATH 155 and ENGR 102

Course Textbook: Browning, Patrick H. and John L. Loth. *Eyes Turned Skyward*. Morgantown, WV, 2015. ISBN-13: 978-1-943665-02-0

Course Description: MAE 215 covers the fundamental physical quantities of flowing gas. Topics include thermodynamics of ideal gas flow using the equation of state and three conservation equations, relating total pressure to total temperature using the concept of entropy and the associated isentropic equations, the standard atmosphere, basic aerodynamic equations, airfoil nomenclature, lift, drag, and aircraft performance. Students will be expected to use MS Word, MS Excel, MS Project, MATLAB, and SolidWorks in this course.

General Course Outline:

Ch. 1. (2 hrs) Introduction to Aerospace Engineering (brief history)
Ch. 2. (3 hrs) Units and the State Equation (relating density to pressure and temperature)
Ch. 3. (5 hrs) The Standard Atmosphere (calculate pressure and temperature values at all altitudes)
Ch. 4. (17 hrs) Conservation Equations (continuity, momentum, and energy equations to solve for velocity, pressure, temperature, density); Viscous Effects (use empirical coefficient to find drag on bodies in flow)
Ch. 5. (12 hrs) Aerodynamic Shapes (2-D incompressible flow airfoil lift and drag, 3-D lift and induced drag)
Ch. 6. (3 hrs) Aircraft Performance (power required, range, endurance, climb rate, take-off, landing, and turns)

Assignments & Grading ("FCG" – Final Course Grade; "KAA" – Key ABET Assignment):

Assignment	Date	No. of Assignments	FCG (%)	ABET Outcome
Homework & Quizzes	*	~15	10	f
Mid-Term Examinations				
Mid-Term Exam I (Ch. 1-3)	Sept. 12th	1	18	f
Mid-Term Exam II (Ch. 4)	Oct. 21st	1	18	f
Mid-Term Exam III (Ch. 5)	Nov. 18th	1	18	f
Semester Project				
Project Milestones	*	4	2	c (4 KAA's)
Project Report & Demo	Dec. 2nd	1	8	c & f (2 KAA's)
Professional Obligations Essay	Oct. 14th	1	4	f (1 KAA)
Engineering Ethics Essay	Nov. 30th	1	4	f (1 KAA)
Final Exam (11 am – 1 pm, ESB G39)	Dec. 12th	1	18	N/A

*see last page of syllabus for detailed schedule

Final Course Grade will be submitted as: A (≥89.5%), B (≥79.5%), C (≥69.5%), D (≥59.5%), F (<59.5%)

Key Course Objectives: It is the intent of this course that upon its completion:

1. Students will have knowledge of fundamental components of aerospace engineering.
2. Students will be able to utilize knowledge from (1.) and apply effective problem solving skills to evaluate and/or design basic aerodynamic-related configurations.

3. Students will have knowledge of contemporary ethical and professional responsibilities and practices as related to the field of engineering.
4. Students will develop a greater concern for evaluation of their own practices in light of knowledge from (3.) and will effectively merge ethically and professionally upright conduct into problem solving.

Key Course Learning Outcomes: Through satisfactory completion of homework, quiz and exam problems, as well as through classroom discussion, successful students will be able to:

1. Demonstrate understanding of basic molecular behavior related to large scale (atmospheric layer) and small scale (local gas flows);
2. Demonstrate understanding of basic fluid flow conservation principles;
3. Demonstrate solution of aerodynamic forces exerted on specific bodies within steady gas flows using empirical formulae and coefficient plots;
4. Demonstrate understanding of contemporary engineering ethical and professional responsibilities applied to specific cases (historical or hypothetical).

Additionally, through the satisfactory completion of the professional obligations and ethical responsibilities, successful students will be able to:

1. Demonstrate understanding of contemporary engineering ethical and professional responsibilities applied to specific cases (historical or hypothetical);
2. Demonstrate the ability to develop and disseminate personal views relating to contemporary engineering ethical and professional responsibilities applied to specific cases (historical or hypothetical).

Additionally, through the satisfactory completion of the course final project, successful students will be able to:

1. Demonstrate the ability to effectively work in teams outside the classroom to design a glider which meets the given design constraints;
2. Demonstrate the ability to work in teams to assemble a professional report which describes the glider design and provides evidence of deliberate design based upon analytical and numerical flight performance estimations;
3. Demonstrate the ability to work in teams to build a glider made of multiple interconnected mechanical components (e.g., wings, fuselage, etc.) to meet a desired flight goal of 40 ft when launched by hand;
4. Demonstrate the ability to verbally convey key glider concepts and design ideas to peers and judges during the glider flyoff competition.

Course Contribution to System Design & Professional and Ethical Components (ABET learning outcomes): Glider projects are graded based on the general design and workmanship, glide performance, and project report which includes dimensioned CAD drawings, a construction log, and tabulated and graphical performance estimations. Approximately 75% of the quizzes as well as all special essay assignments in MAE 215 will directly concern engineering ethics and professional obligations with special focus on the various aspects addressed in the National Society of Professional Engineers (NSPE) Code of Ethics for Engineers. A portion of class lecture time is devoted to discussion of hypothetical, historical, and contemporary situations which exhibit immediate ethical ramifications. ABET key course outcomes c & f are as follows:

ABET Outcome c: An ability to design a system, component, or process to meet desired needs	**ABET Outcome f: An understanding of professional and ethical responsibility**
Graduates will demonstrate an ability to design a mechanical system, component, or process to meet a desired need.	Graduates will have an understanding of professional responsibility.
Graduates will demonstrate an ability to design a thermal system, component, or process to meet a desired need	Graduates will have an understanding of ethical responsibility.

Fall 2015 General Academic Calendar Key Dates:

Aug. 17	First day of classes	Nov. 11	Veteran's Day (DSC)
Aug. 23	Last day to register	Nov. 12	Birth of Baha'u'llah (DSC)
Sept. 5	Labor Day Recess (No Classes)	Nov. 19-27	Fall Recess (No Classes)
Oct. 3	Rosh Hashanah (DSC)	Dec. 5	Last day to withdraw from University
Oct. 5	Mid-Semester	Dec. 6	Last day of classes
Oct. 12	Yom Kippur (DSC)	Dec. 7	Finals prep day
Nov. 8	Election Day (No Classes)	Dec. 8-14	Final Exams Week
Oct. 26	Last Day to Drop a Class	*DSC – Day of Special Concern	

Attendance: Attendance is required to successfully complete the course. Attendance will be taken at the beginning of every lecture period. The final course grade will be reduced by 2% for each unexcused absence in excess of 2 days after Aug. 31st.

Late Policy: Homework will be accepted up to one day late at a penalty of 50% grade reduction. Quizzes cannot be made up (at least one quiz grade will be dropped to accommodate excused absences). Exams will only be administered at times other than their originally-scheduled times for WVU-sanctioned and other excused absences or other extenuating circumstances. Project reports will not be accepted late under any circumstance.

Additional Exam Policy: The following guidelines are imposed during every exam in MAE 215:

1. Absolutely NO WIRELESS COMMUNICATION DEVICES are allowed to be used during the testing period.
2. Exams are "closed book".
3. Students must maintain one empty seat between themselves and their neighbors (exceptions may be made if space is unavailable).
4. All midterm exams must be returned to the instructor and/or proctor by 3:55 pm; all final exams must be returned within the allotted two-hour exam period (exceptions will of course be made for students with documented disabilities).

Academic Integrity and Honesty Statement (Official WVU Statement): The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at http://studentlife.wvu.edu/studentconductcode.html. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter.

Social Justice, Disability, and Inclusivity Statement (Official WVU Statement): The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu.

Disclaimer: The instructor reserves the right to deviate from the syllabus when a change is in the best interests of the class, as determined by the instructor.

Period(s)	Total	Date(s)	L, Q, E, R, S, B	Description	Ch.	Assignment(s)	ABET	Due Date
1	1	8/17	L	Introduction, historical notes	1	Read Ch1, HW#1: Prob. 1.1-7		8/24
1	2	8/19	L	Engineering fundamentals	1	Read Ch2		8/26
1	3	8/22	L	Units	2	Prof. Responsibility Essay	f	10/14
1	4	8/24	L	State equation	2	Read Ch3, HW#2: Prob. 2.1-8		9/2
1	5	8/26	L	Moving gases	2			9/2
1	6	8/29	L	Orbital mechanics, escape velocity, conic sections	3	HW#3: Prob. 3.1-8		9/9
3	9	8/31 – 9/7	L	Standard atmosphere	3			9/9
N/A	**6**	**9/5**	**B**	**Labor Day Recess**	**N/A**			
1	10	9/9	L, R	NSPE Code of Ethics for Engineers, Exam Review	1 - 3		f	
1	**11**	**9/12**	**E**	**Exam I**	**1 - 3**	**Read Ch4: S1-S3**	**f**	**9/16**
1	12	9/14	L	Steady vs. unsteady flows	4	Proj1:Team Info	c	9/21
2	14	9/16 – 9/19	L	Continuity	4	HW#4: Prob. 4.1-2,4.4-5		9/23
2	16	9/21 – 9/23	L	Momentum	4	Read Ch4:S4-S6		9/28
2	18	9/26 – 9/28	L	Euler & Bernoulli	4	HW#5: Prob. 4.3,4.6-8		10/3
2	20	9/30 – 10/3	L	Energy	4	Read Ch4:S7-S10		10/7
1	21	10/5	L	Isentropic relations	4	Read Ch4:S11-S15		10/14
2	23	10/7 – 10/10	L	Dimensional analysis, Buckingham Pi, Reynolds number	4	Proj2: Rough Design	c	10/19
1	24	10/12	L	Boundary layers	4	HW#6: Prob. 4.9-12		10/19
2	26	10/14 - 10/17	L	Drag on bodies in flow	4	Engr. Ethics Essay	f	11/30
1	27	10/19	L, R	Professional Obligations, Exam Review	4		f	
1	**28**	**10/21**	**E**	**Exam II**	**4**	**Read Ch5:S1-S2**	**f**	**10/31**
1	29	10/24	L	Conventional aircraft basics	5	HW#7: Prob. 5.1-5		11/2
4	33	10/26 - 11/2	L	Airfoils	5	Read Ch5:S3-S4		11/4
2	35	11/4- 11/7	L	Finite wings	5	Read Ch5:S5-S6; HW#8: Prob. 5.6-11		11/14
2	37	11/9 - 11/11	L	Computational airfoil analysis	5	Read Ch6:S1-4	c	11/16
1	38	11/14	S	Classroom Glider Construction	5	Proj3: Classroom Build Day	c	11/14
1	39	11/16	L, R	Mechanical System Design, Exam Review	5	Proj4: CAD/BOM	c	11/30
1	**40**	**11/18**	**E**	**Exam III**	**5**	**Read Ch6:S5-8**	**f**	**12/2**
N/A	**40**	**11/21 - 11/25**	**B**	**Fall Break**	**N/A**			
1	41	11/28	L	Orientation, propulsion, endurance, & range	6	HW#9: Prob. 6.1-7		12/2
1	42	11/30	L	Takeoff & landing distance, banking, & service ceiling	6			
1	43	12/2	S	Glider fly-off	1 - 6	Proj5: Final Report	c	12/2
1	44	12/5	R	Final Exam review	1 - 6			
N/A	**44**	**12/12**	**E**	**Final Exam (11 am – 1 pm)**	**1 - 6**			**12/12**